US006804917B2

(12) **United States Patent**
Ensign

(10) **Patent No.: US 6,804,917 B2**
(45) **Date of Patent: Oct. 19, 2004**

(54) **STORAGE STRUCTURE FOR SAILPLANES AND SMALL AIRCRAFT**

(76) Inventor: **Richard Ensign**, 1295 S. Cawston, Spade No. 494, Hemet, CA (US) 92545

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 23 days.

(21) Appl. No.: **10/300,086**

(22) Filed: **Nov. 20, 2002**

(65) **Prior Publication Data**

US 2004/0093807 A1 May 20, 2004

(51) **Int. Cl.**[7] **E04B 1/344**
(52) **U.S. Cl.** ..... **52/69**; 52/23; 52/653.2; 52/DIG. 14; 244/114 R
(58) **Field of Search** ..... 52/69, DIG. 14, 52/23, 653.1, 653.2; 244/114 R

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,260,369	A	*	10/1941	Ebenhack	52/69
2,532,456	A	*	12/1950	Merritt	49/40
2,610,366	A	*	9/1952	McKee et al.	49/40
2,759,226	A	*	8/1956	McKee et al.	49/140
3,034,607	A	*	5/1962	Haines, Jr.	52/64
3,074,518	A	*	1/1963	Conrad et al.	52/69
3,353,862	A	*	11/1967	Tormolen	410/2
3,550,333	A	*	12/1970	Kliewer	52/73
3,673,749	A	*	7/1972	Allen	52/73
3,708,200	A	*	1/1973	Richards	296/173
3,818,652	A	*	6/1974	Pierce	52/23
3,823,519	A	*	7/1974	Cordova	52/65
3,838,879	A	*	10/1974	Lilly	52/143
3,858,371	A	*	1/1975	Averill	52/66
3,906,691	A	*	9/1975	Grenet	52/236.1
3,954,197	A	*	5/1976	Dean	414/800
4,004,382	A	*	1/1977	Carlson	52/64
4,464,868	A	*	8/1984	Howroyd	52/69

* cited by examiner

Primary Examiner—Brian E. Glessner

(57) **ABSTRACT**

A storage structure or hangar designed primarily for housing a sailplane or other small aircraft has a substantially T-shaped pre-fabricated upper frame support anchored to the ground at several locations, a first set of frame members mounted immovably to the upper frame support in areas where the fuselage and tail and the two wings are located when the sailplane or small aircraft is in the storage structure, and a second set of frame members hingedly mounted in part to the upper frame support and partly to first set of frame members. The second set of frame members are located substantially where the front or cockpit of the plane is located and in front of the wings. Panels covering the first and second frame members and enclosing the structure are mounted to the first and second frame members. A cable, chain or like mechanism operated by a winch raises the second set of hinged frame members together with the cover panels mounted thereon to allow the sailplane to be placed into the storage structure. The winch also lowers the second set of frame members to close the structure and enclose the plane therein. The winch is powered by a battery that is charged by a solar panel associated with the structure.

19 Claims, 15 Drawing Sheets

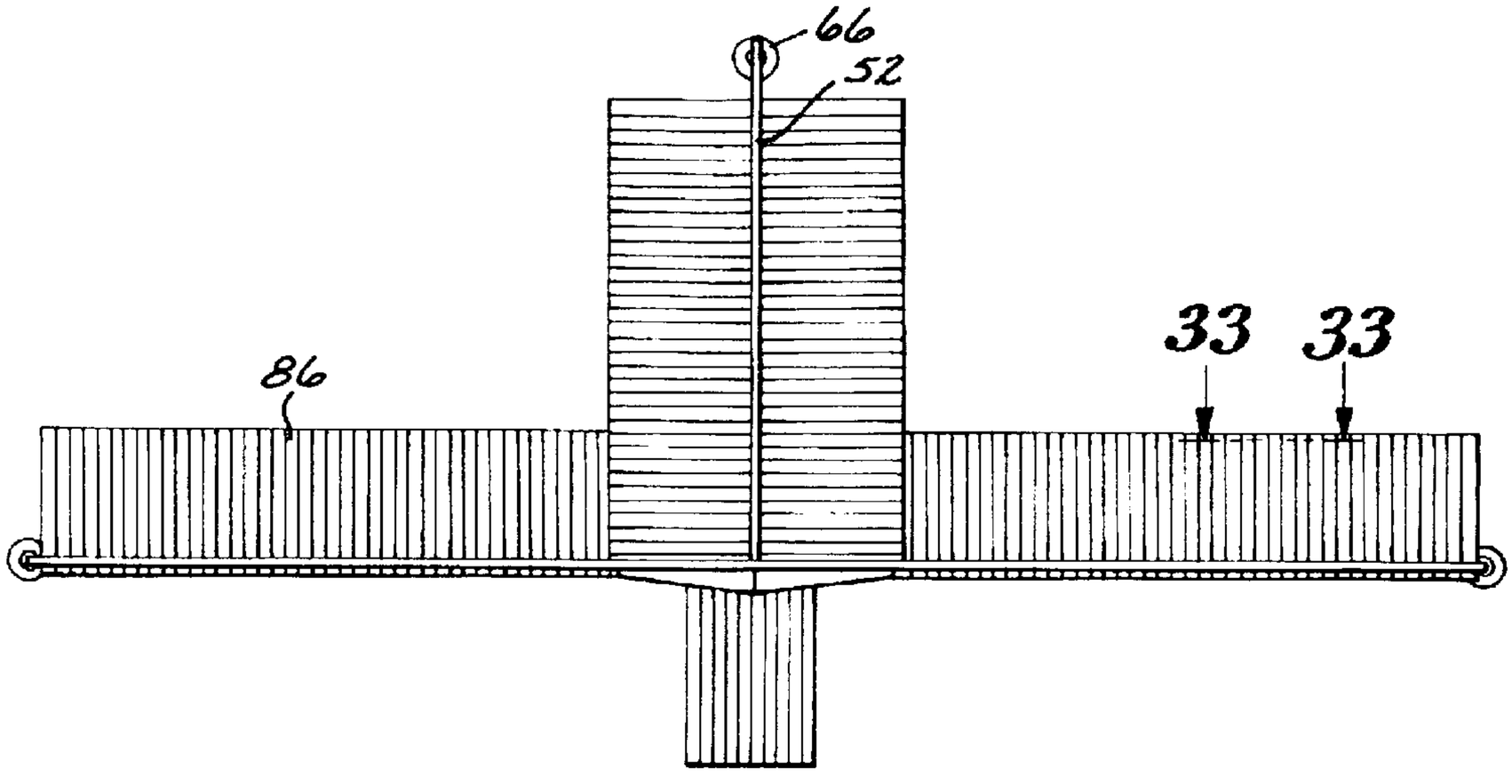


FIG. 1

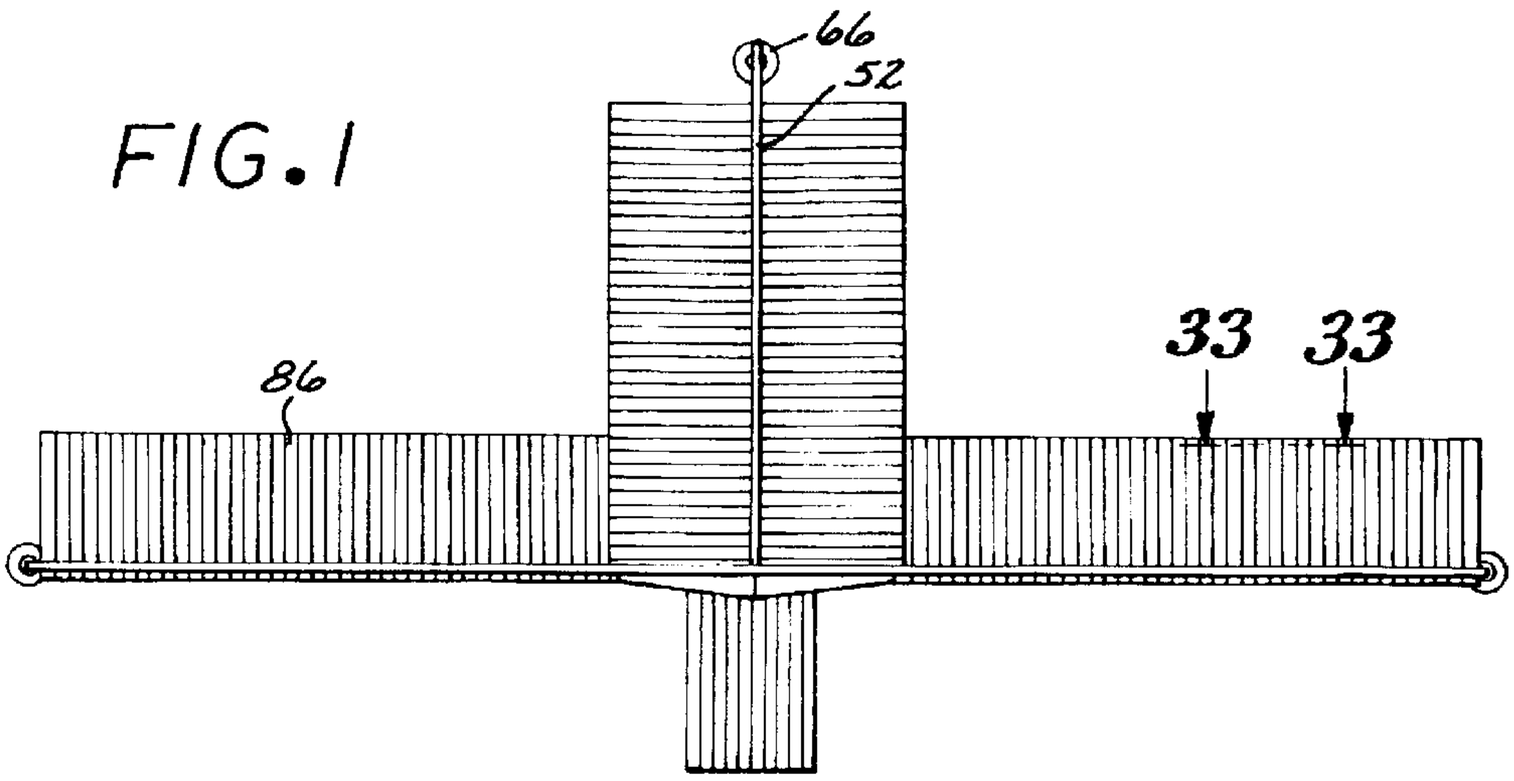


FIG. 2

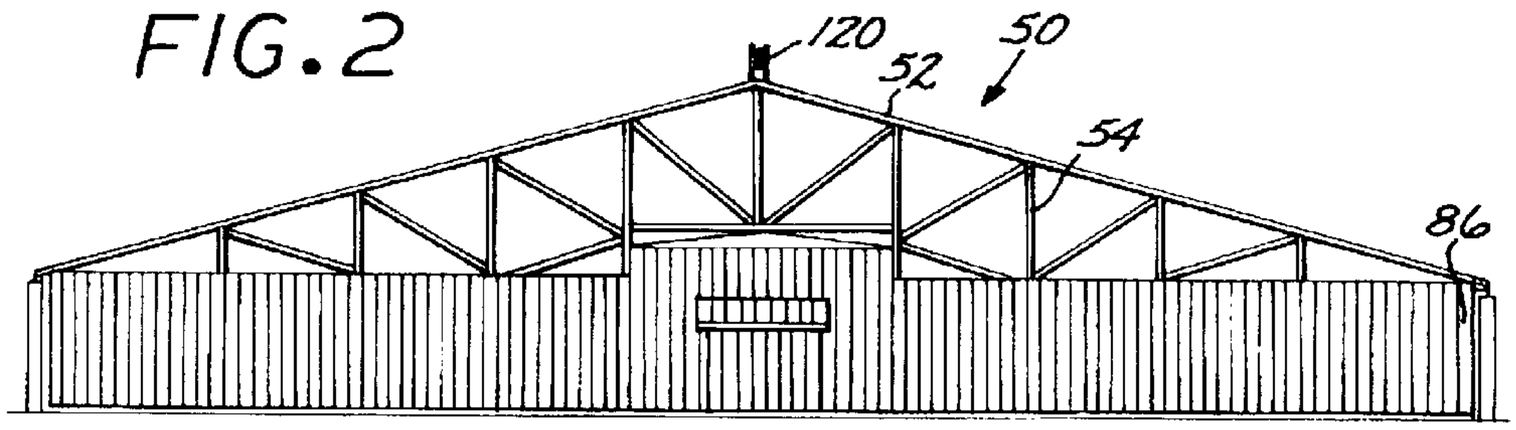


FIG. 3

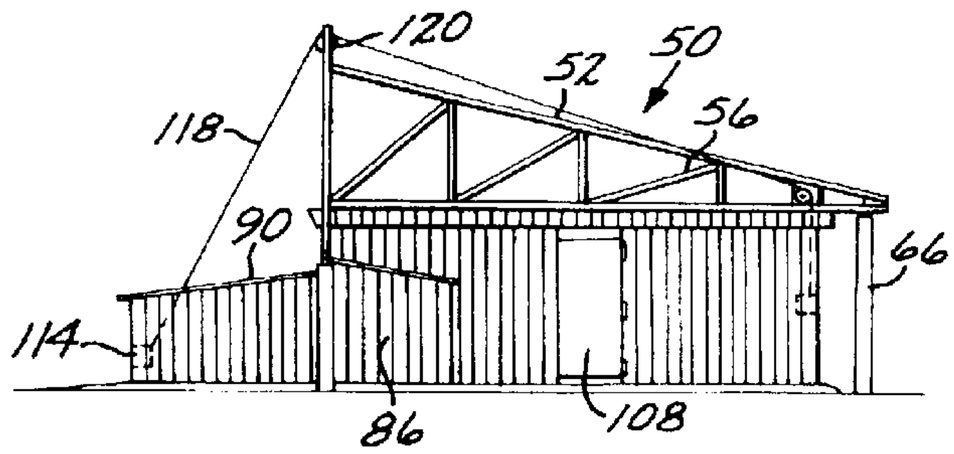


FIG. 4

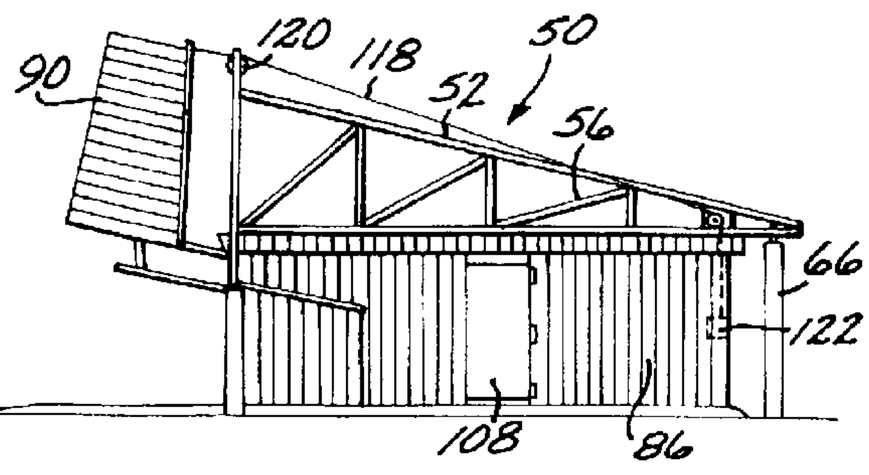


FIG. 5

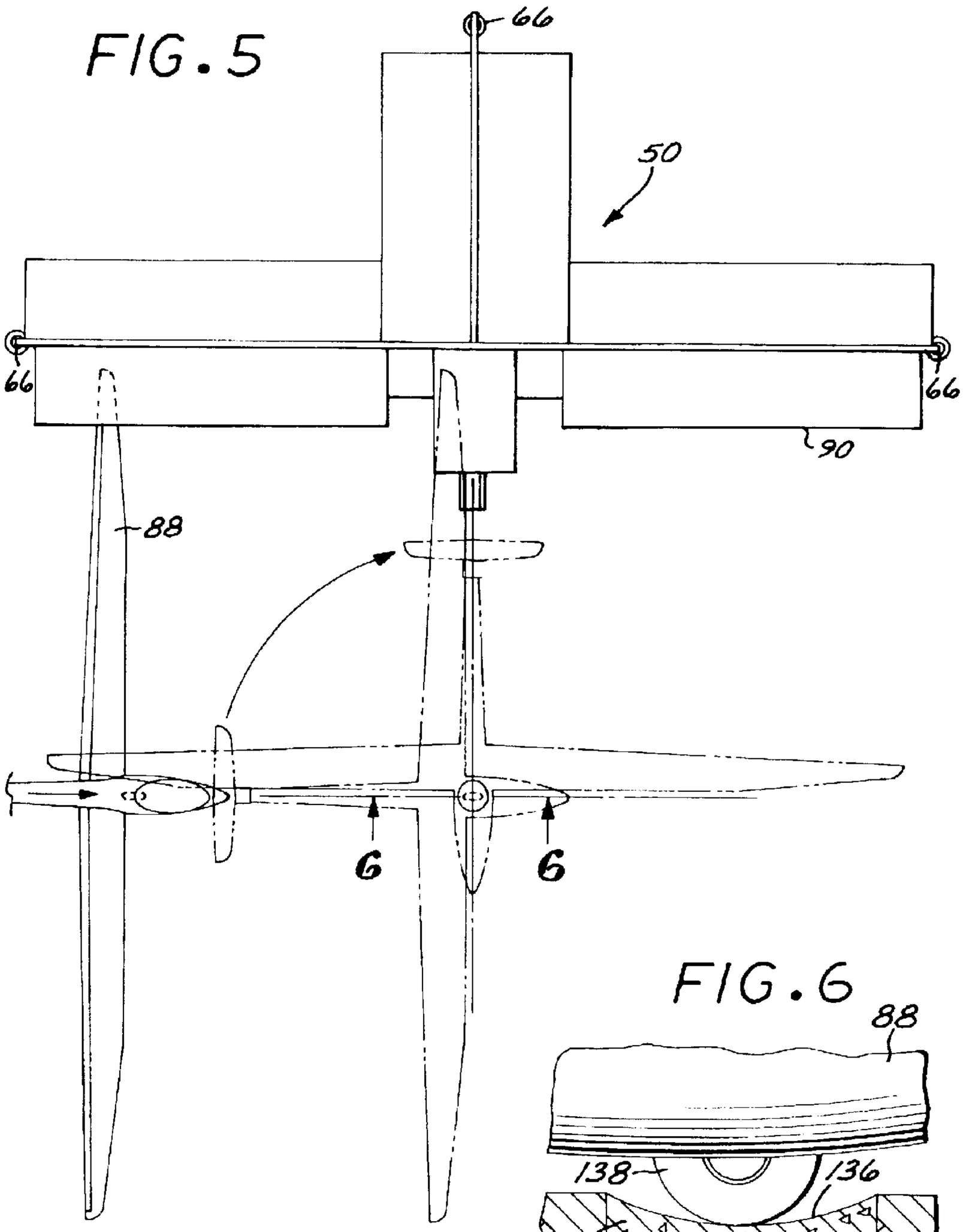


FIG. 6

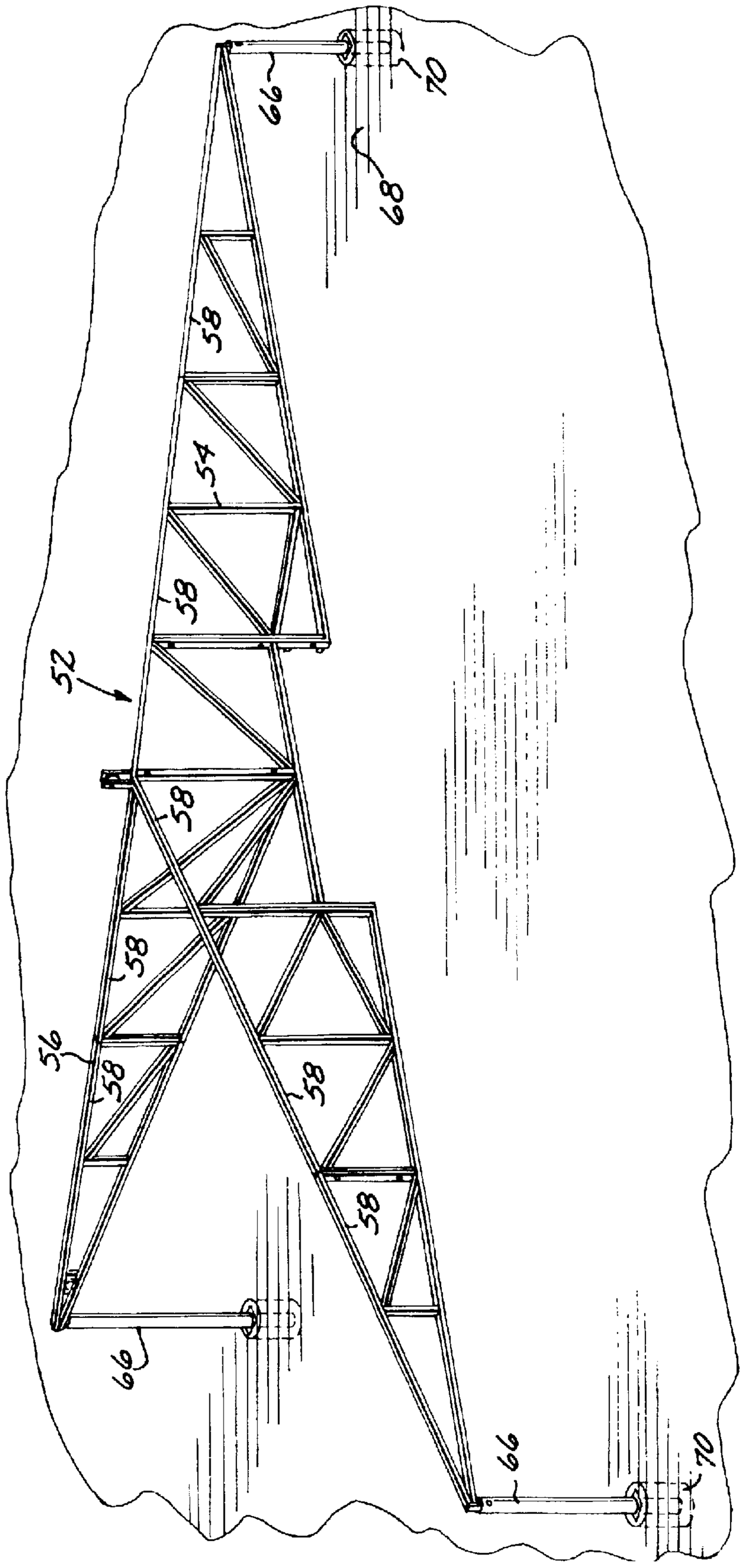


FIG. 7

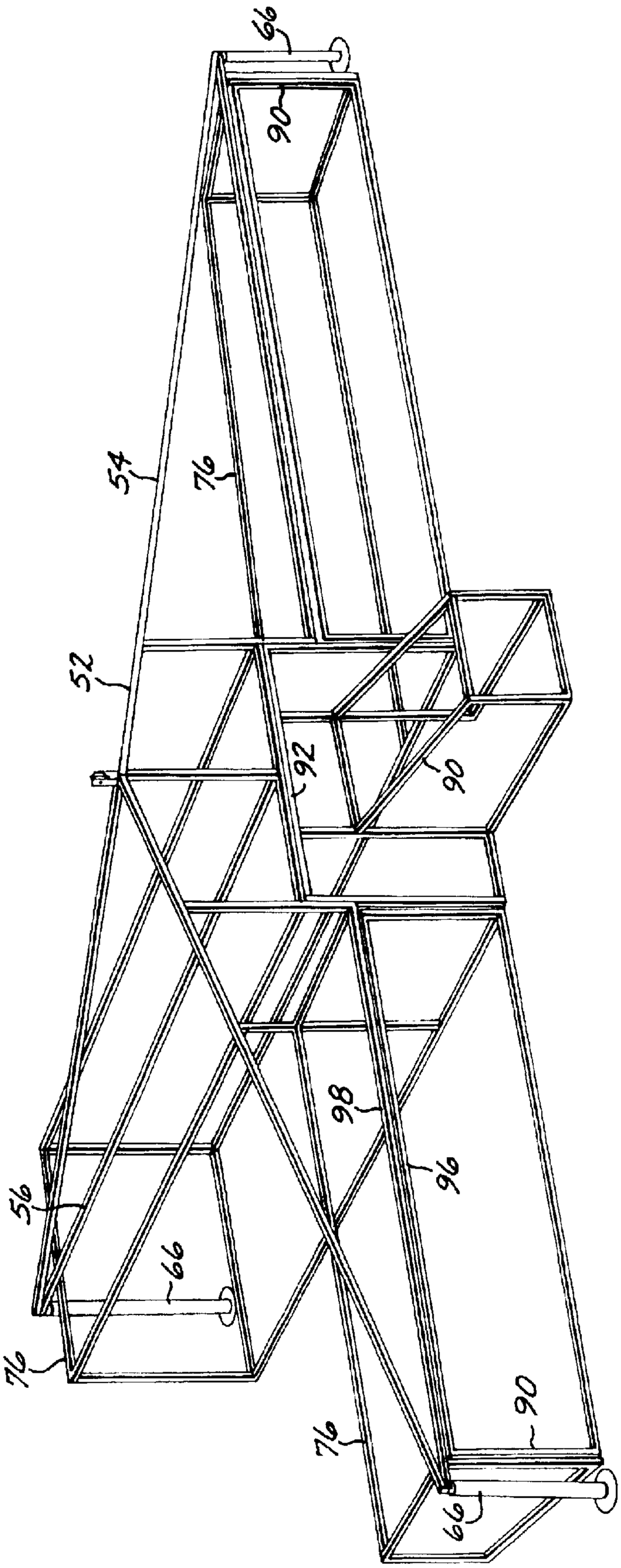


FIG. 7A

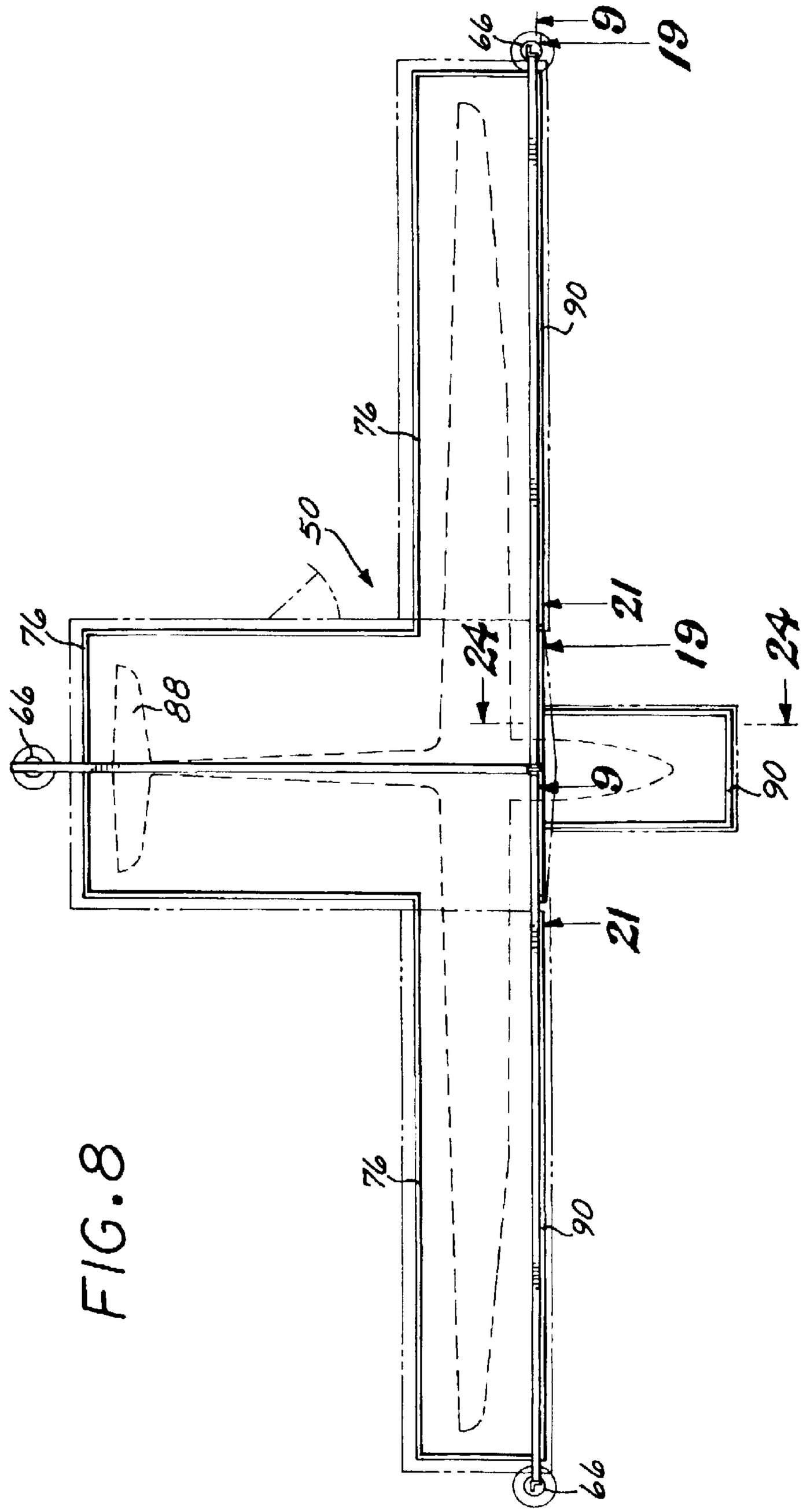


FIG. 8

FIG. 9

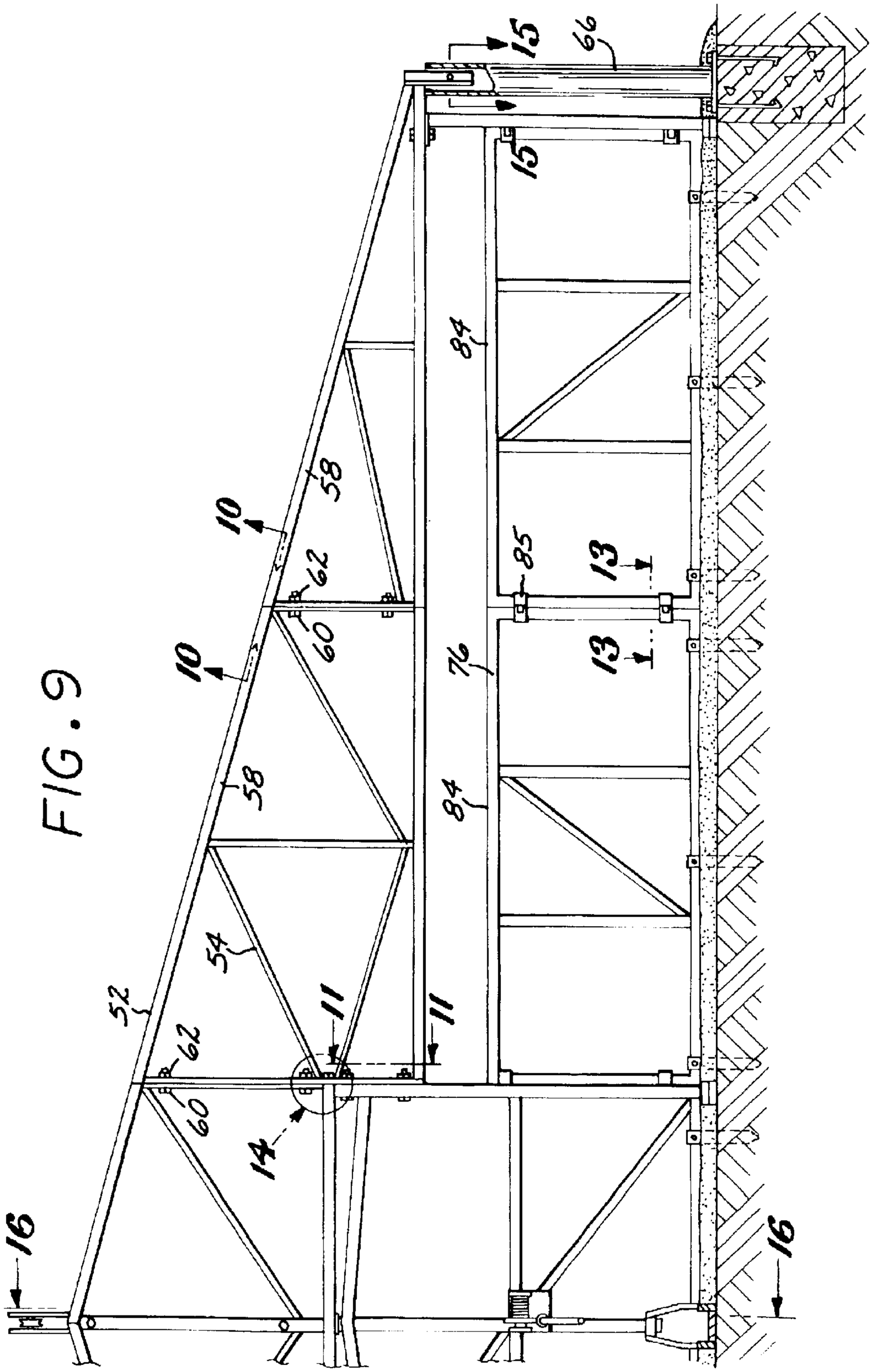


FIG. 10

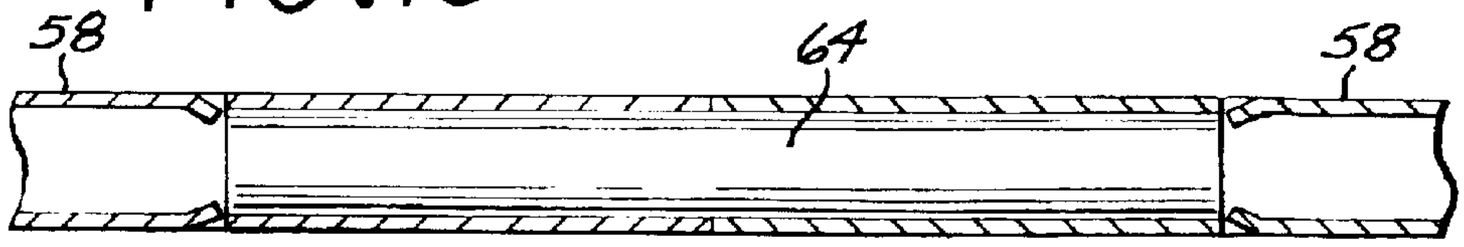


FIG. 11

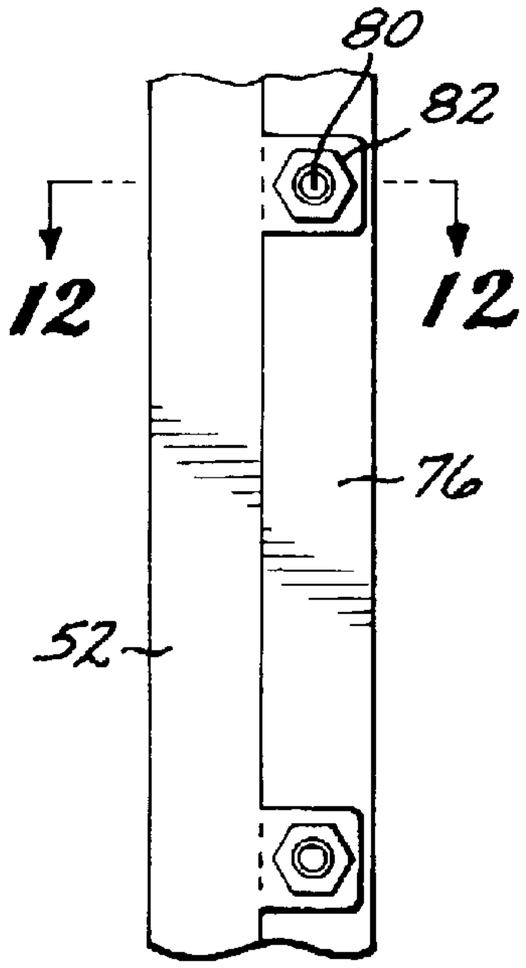


FIG. 12

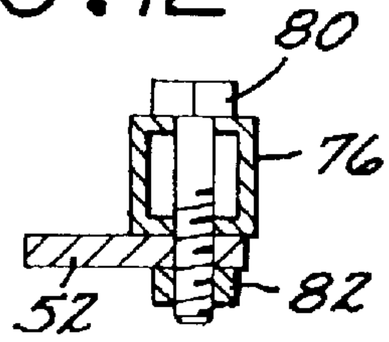


FIG. 13

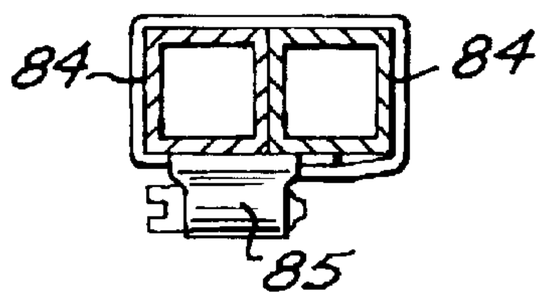
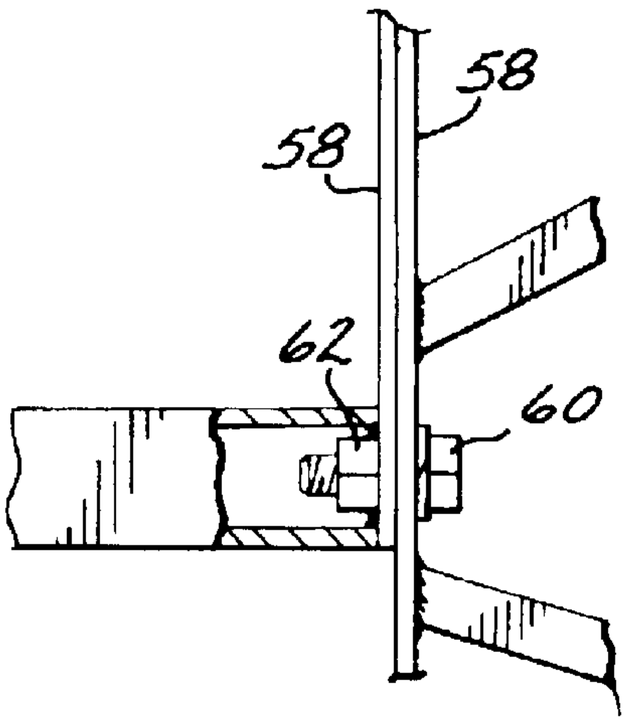


FIG. 14



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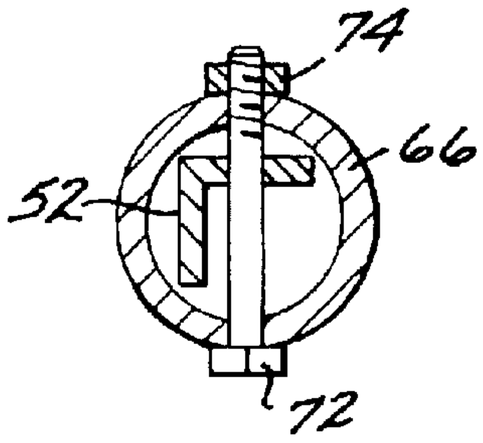


FIG. 17

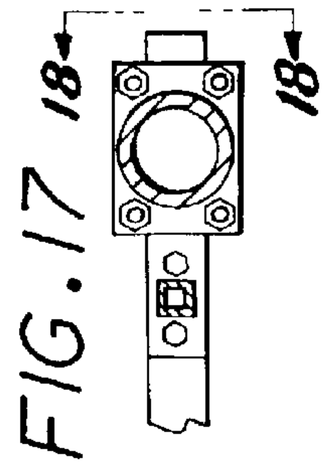


FIG. 18

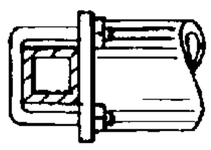


FIG. 16

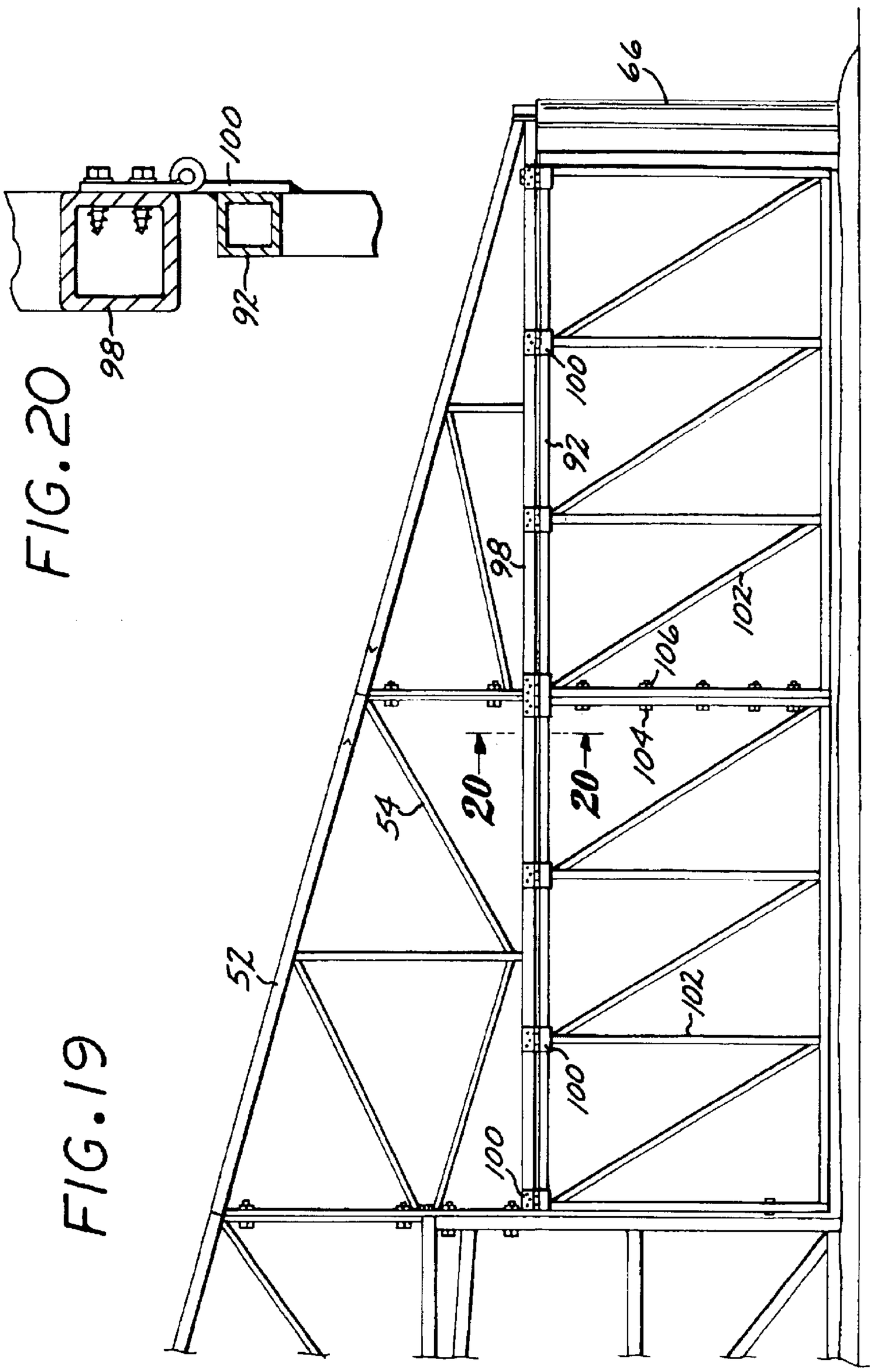
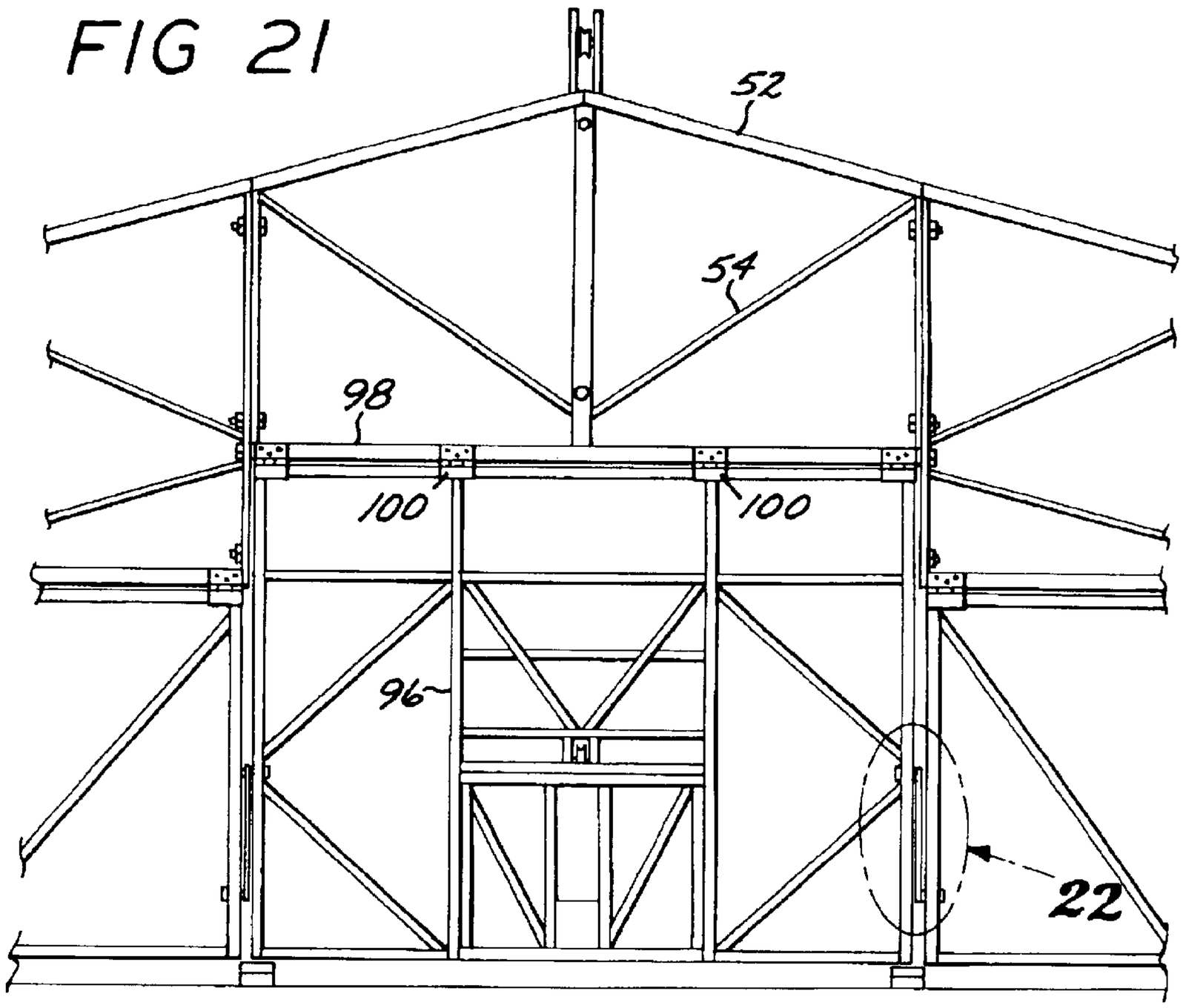


FIG. 20

FIG. 19

FIG 21



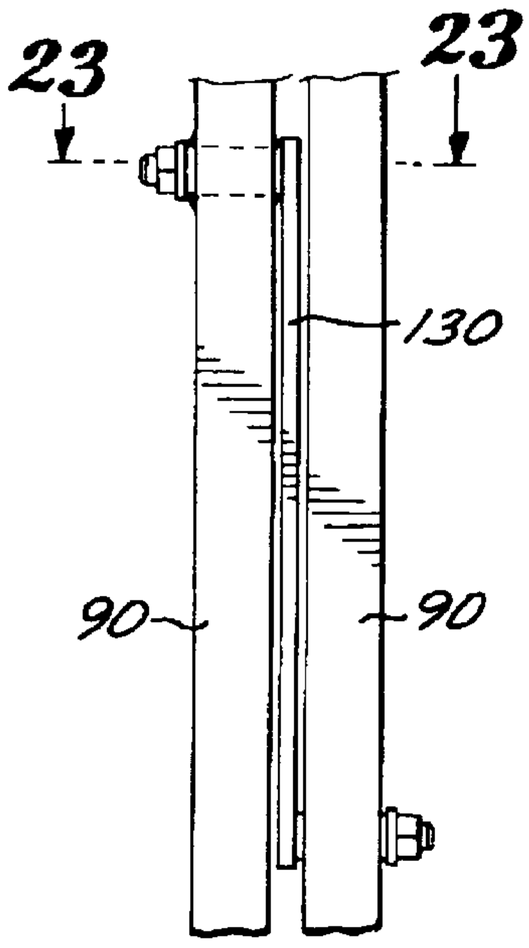


FIG 22

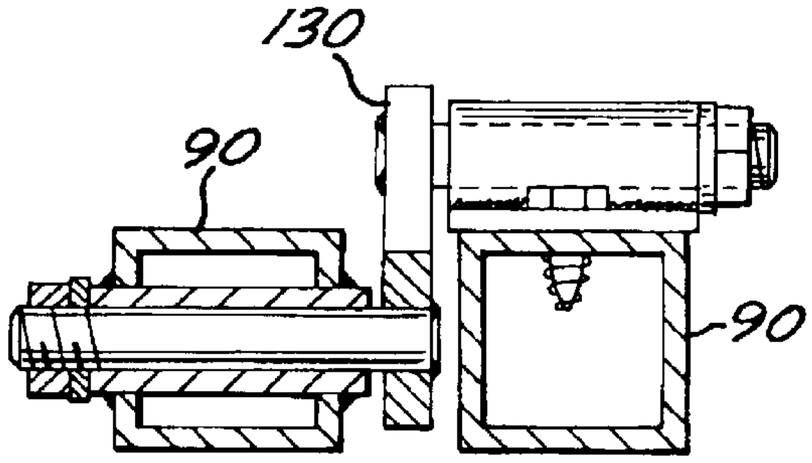
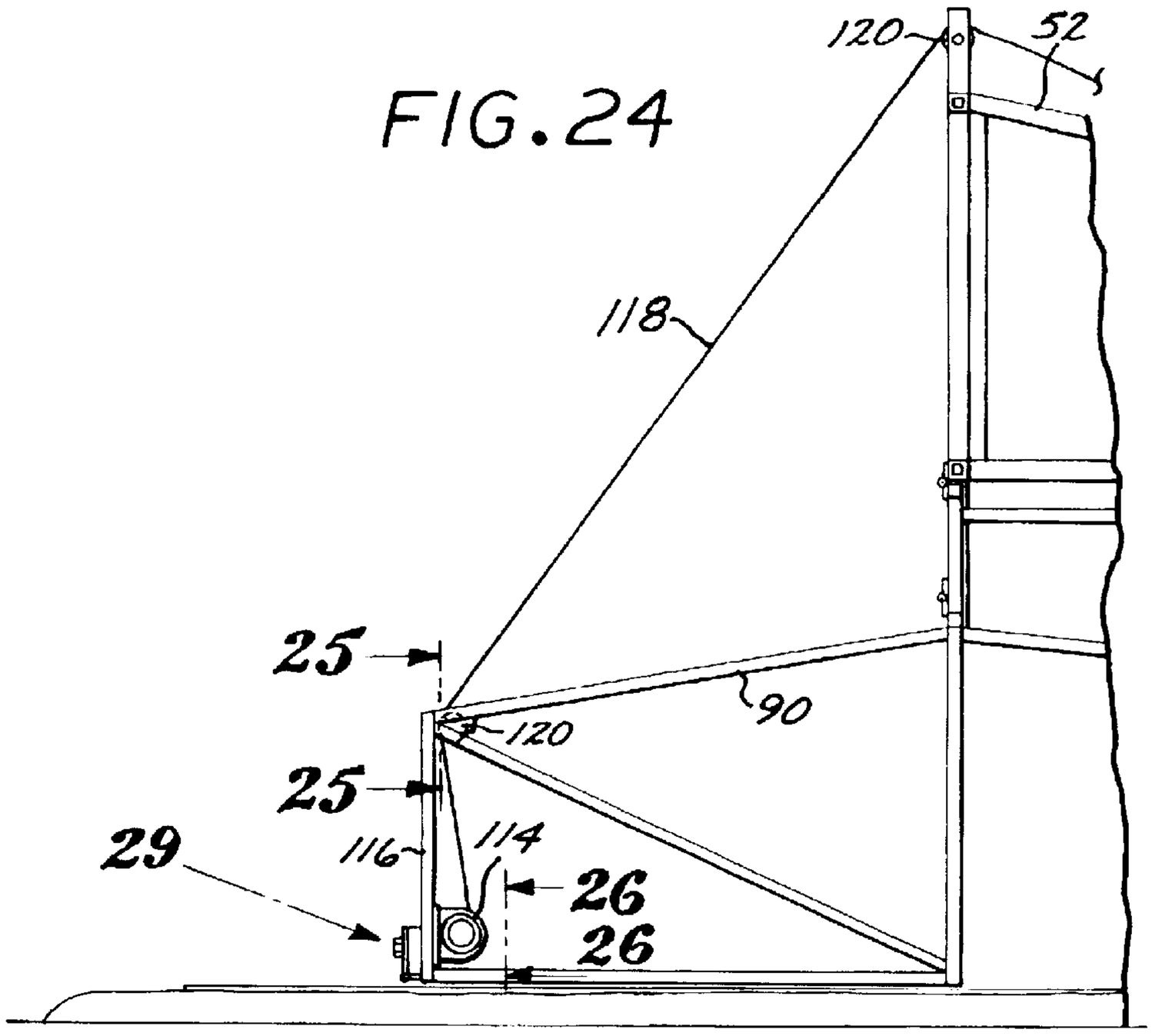


FIG.23

FIG. 24



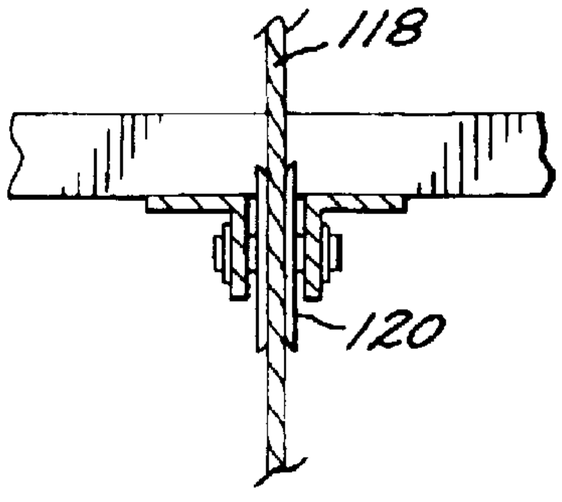


FIG. 25

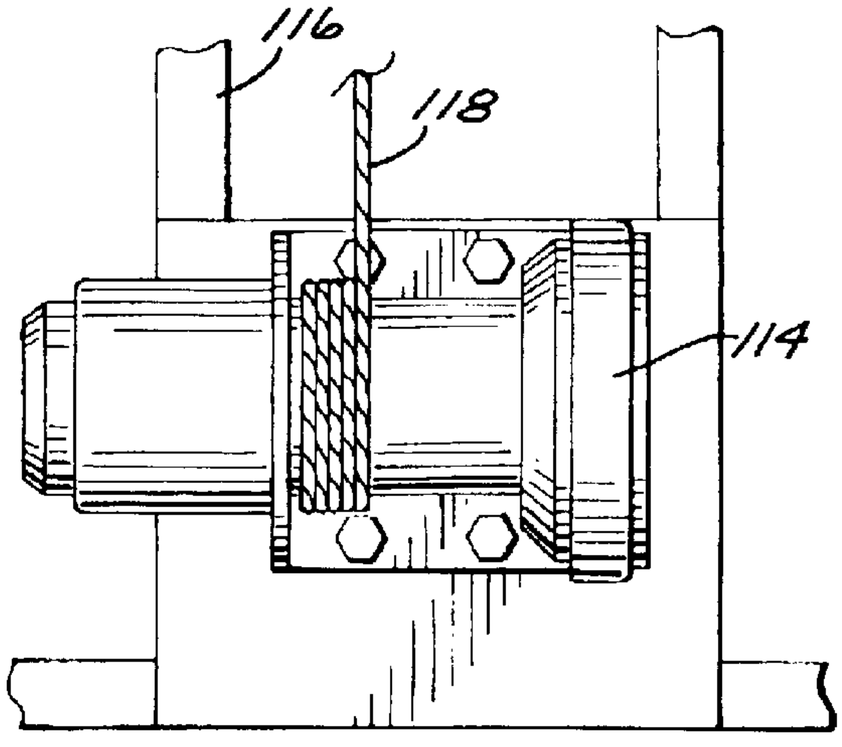


FIG. 26

FIG. 27

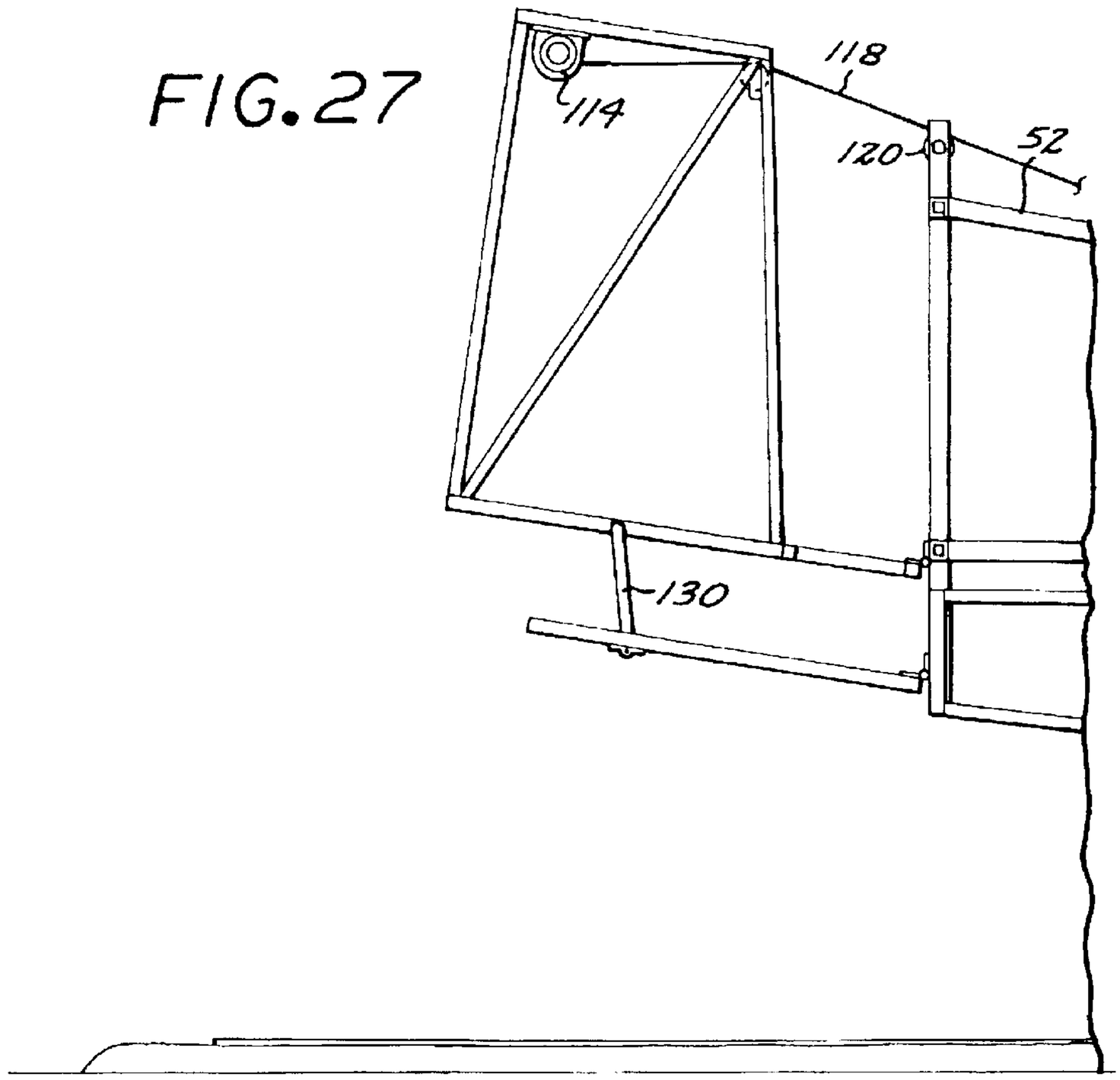
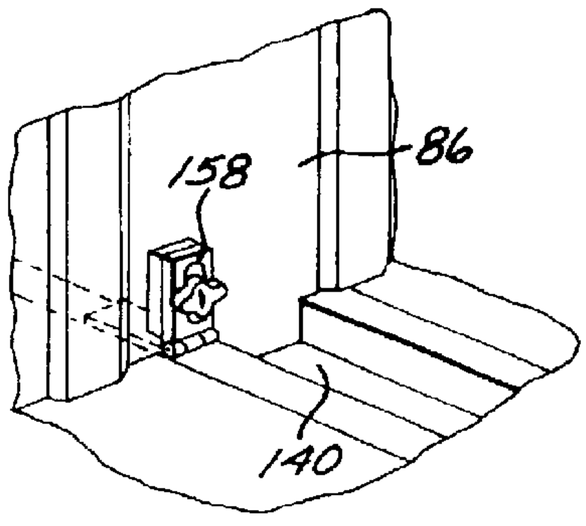


FIG. 28

FIG. 29



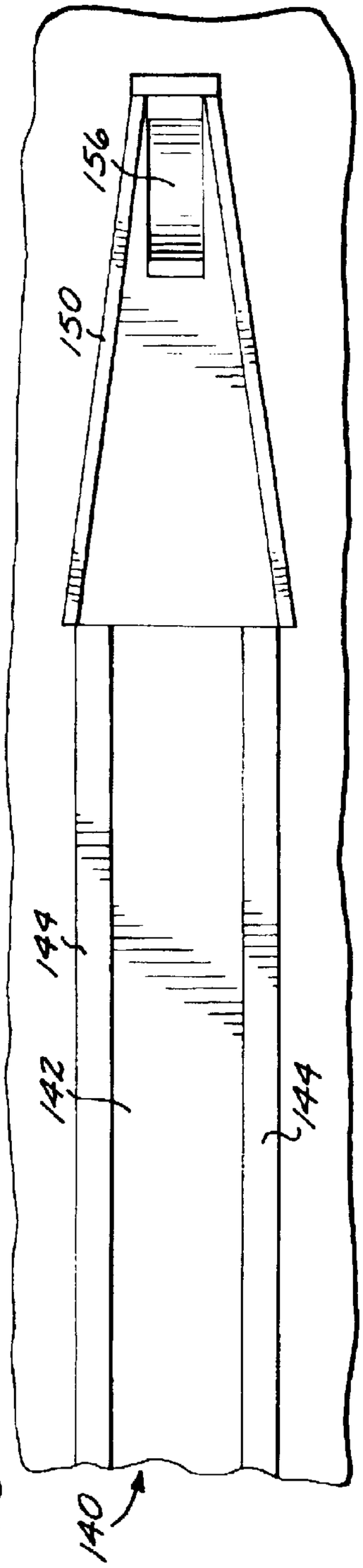


FIG. 30

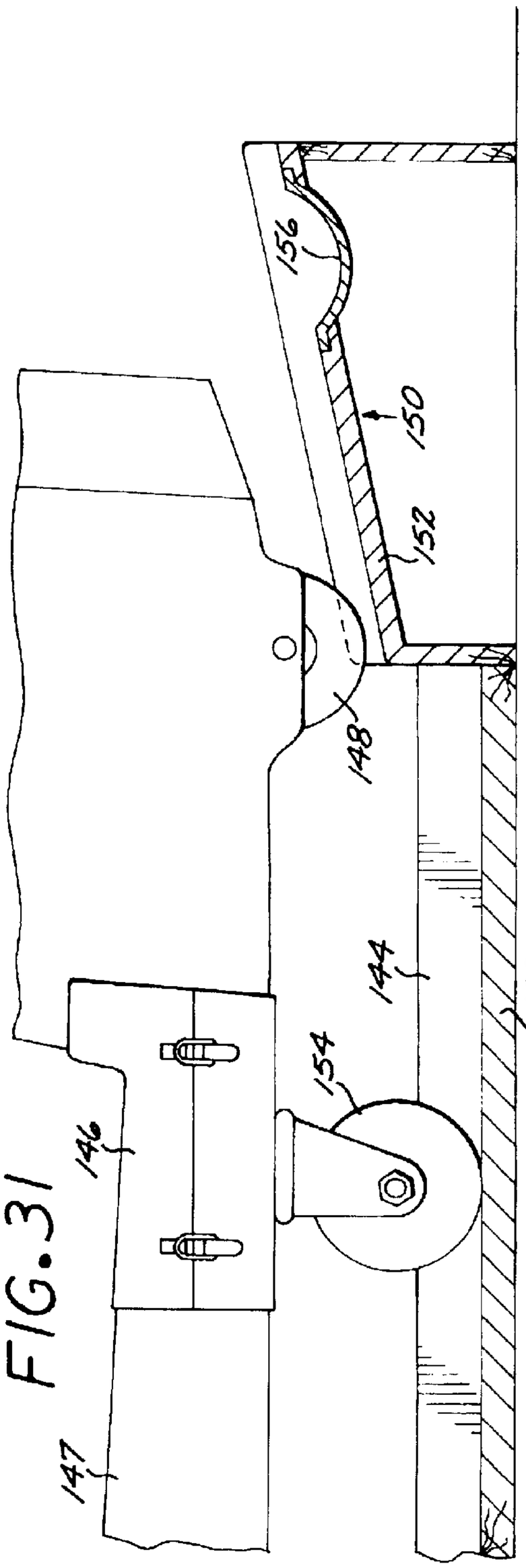


FIG. 31

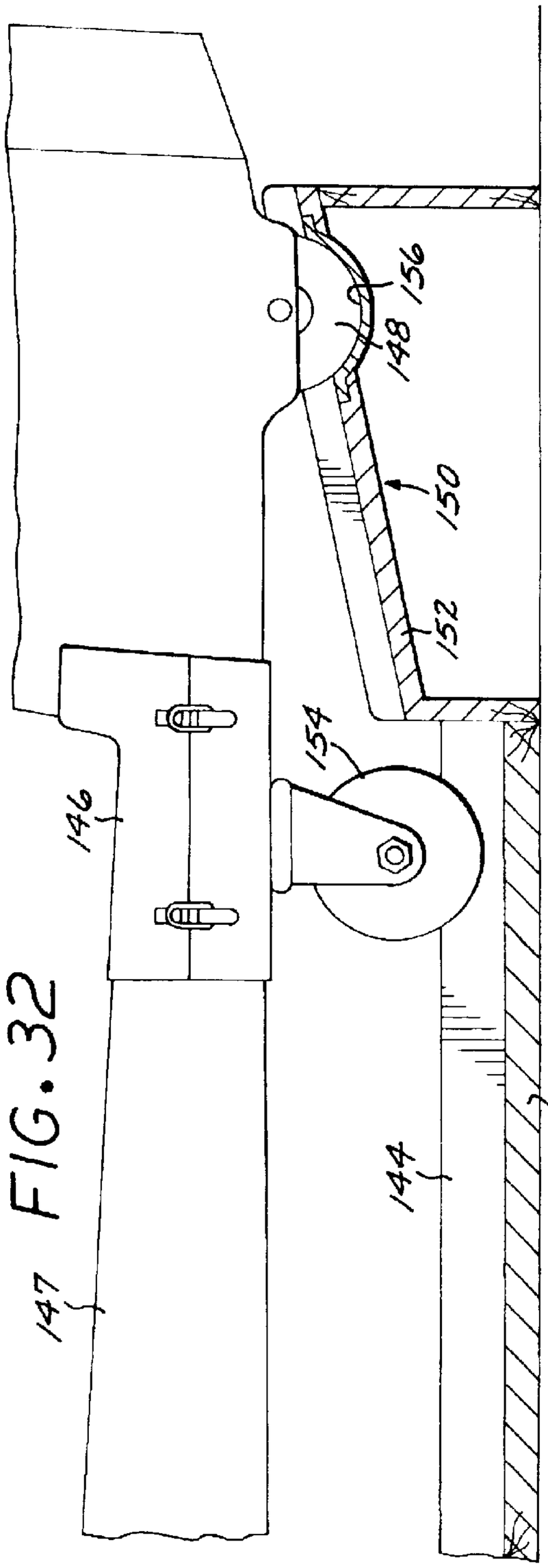


FIG. 32

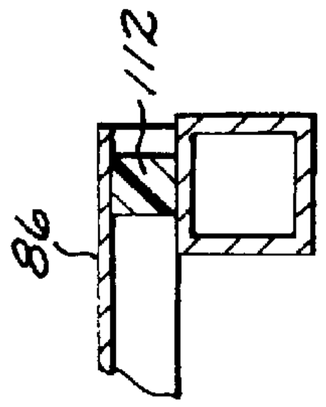


FIG. 34

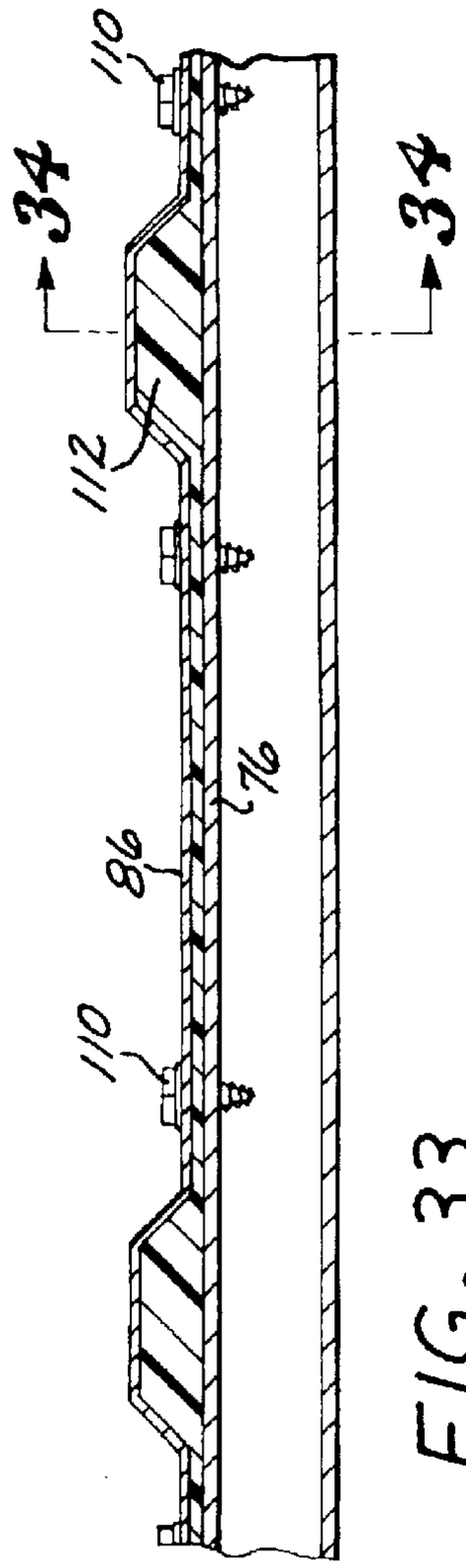
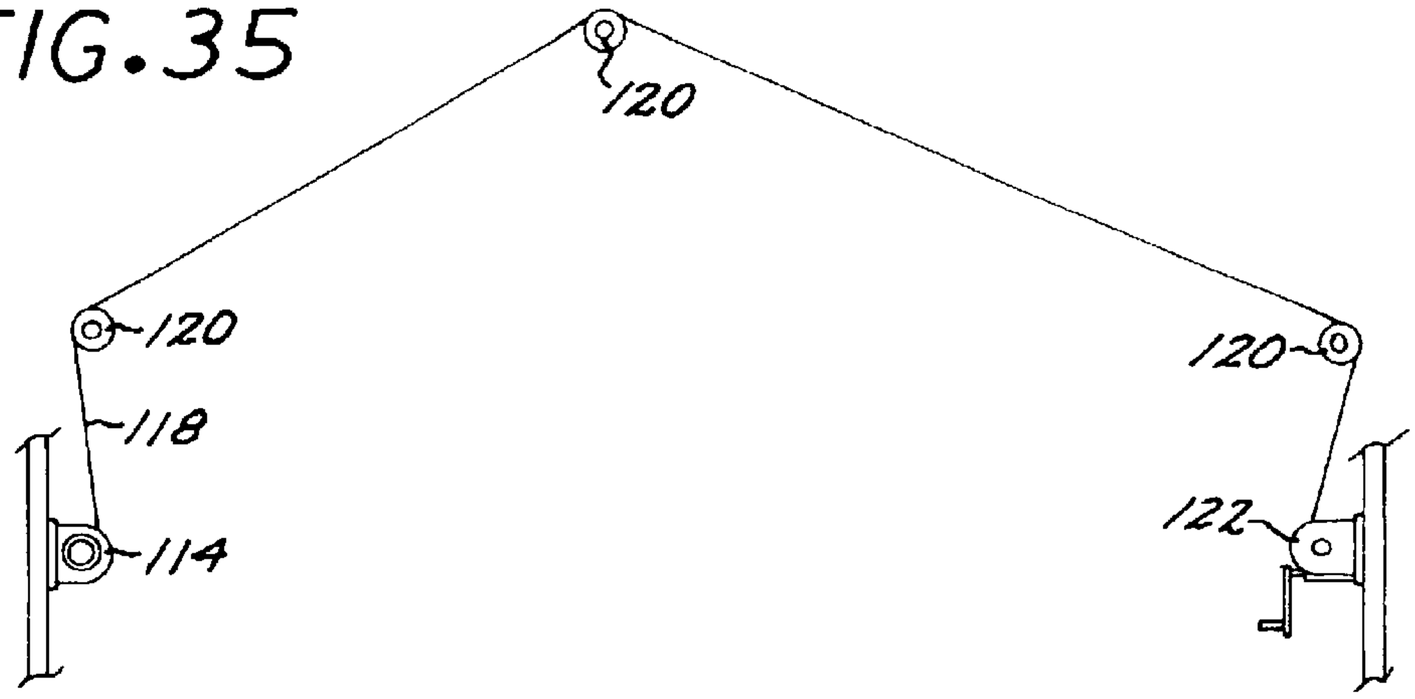


FIG. 33

FIG. 35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120
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114
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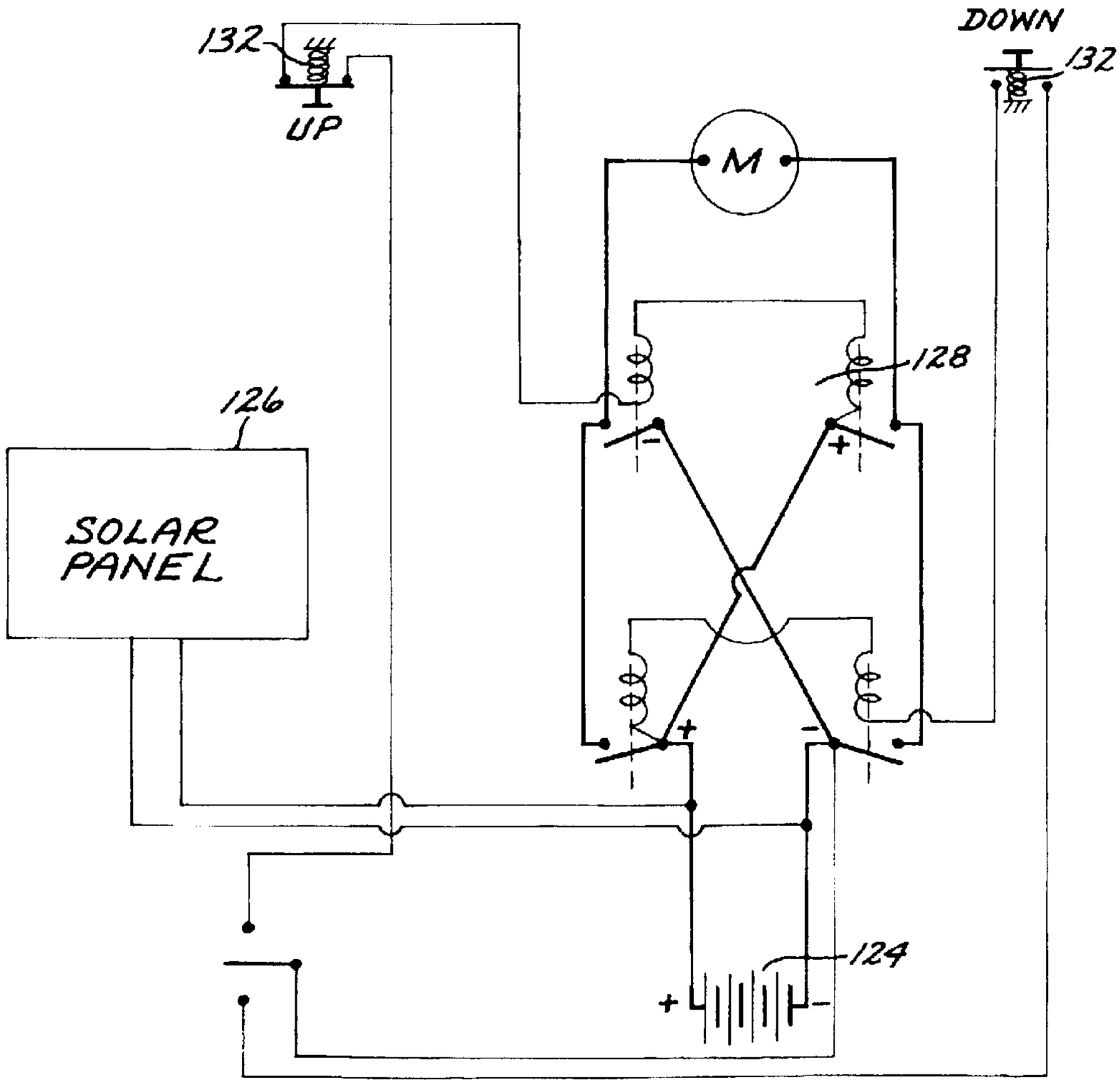
FIG. 36


132
UP
DOWN
132
M
128
126
SOLAR PANEL
124

STORAGE STRUCTURE FOR SAILPLANES AND SMALL AIRCRAFT

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is in the field of structures designed to house sailplanes and small aircraft. More particularly, the present invention pertains to a structure which is specifically suited for protecting sailplanes and other small aircraft from exposure to the elements.

2. Brief Description of Background Art

It is well known that small aircraft is best stored in hangars or like buildings where the aircraft is protected from exposure to the elements. This is particularly true for sailplanes (also known as gliders) which in modern times are usually made from fiber glass, carbon fiber or like synthetic material. It is known that these synthetic materials are severely damaged by prolonged exposure to the sun. However, storage space in hangars or like structures is usually limited in the airports and airfields where sailplanes are normally operated, and when storage space is available it is usually expensive. Sailplanes are often moved from one airfield to another or are retrieved from off-airfield landings in covered trailers in which the sailplane can be stored and transported but only if the wings are first disassembled from the fuselage. For this reason many sailplane owners or operators have specifically dimensioned trailers for each sailplane.

In order to avoid exposing sailplanes, especially sailplanes made from fiberglass, carbon fiber or like synthetic material to the elements the owners or pilots usually remove the wings from the sailplane and store the sailplane in its covered trailer even when there is no intention or need to move the disassembled sailplane from one location to another. However, as it is known by those familiar with sailplane operations, sailplane wings are heavy, and removing them can be burdensome and time-consuming, especially when this operation is performed by one person. Reassembling the wings to the sailplane to make it airworthy again is equally burdensome and time consuming. Moreover, the reassembly of the wings and reconnection of the control surfaces must be performed with absolute precision with no room for error, since failure of properly attaching the wings to the fuselage, and/or failure of properly connecting the control surfaces is likely to cause serious and possibly fatal crashes.

The present invention provides a solution to the problem of disassembling sailplanes for storage just to protect them from the elements, and provides convenient and relatively inexpensive storage space for sailplanes and other small aircraft.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide storage space for housing a sailplane or like small aircraft whereby the sailplane or aircraft is protected from the elements.

It is another object of the present invention to provide storage space for a sailplane or like small aircraft that is relatively inexpensive to manufacture.

It is still another object of the present invention to provide storage space for a sailplane or like small aircraft that can be assembled at the site of usage from pre-fabricated parts.

It is yet another object of the present invention to provide storage space for a sailplane or like small aircraft which is easy to operate.

It is a further object of the present invention to provide storage space for a sailplane or like small aircraft that is operated by electric power without being dependent on a power grid.

These and other advantages are attained by a storage structure or hangar which has a substantially T-shaped pre-fabricated truss or upper frame support anchored to the ground at a plurality of locations, first set of frame members mounted immovably to the truss or upper frame support in areas where the fuselage and tail and the two wings are located when the sailplane or small aircraft is in the storage structure, and a second set of frame members hingedly mounted in part to the truss or upper frame support and partly to first set of frame members. The second set of frame members are located substantially where the front or cockpit of the plane is located and in front of the wings. Panels covering the first and second frame members and enclosing the structure are mounted to the first and second frame members. A cable, chain or like mechanism operated by a winch raises the second set of hinged frame members together with the cover panels mounted thereon to allow the plane to be placed into the storage structure. The winch also lowers the second set of frame members to close the structure and enclose the plane therein.

The foregoing and other objects and advantages attained by the present invention will become readily apparent from the following description taken together with the appended drawings where like numerals indicate like parts.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a top plan view of the storage structure or hangar of the present invention.

FIG. **2** is a front plan view of the storage structure or hangar of the present invention.

FIG. **3** is a side view of the storage structure or hangar of the present invention, the view showing a second hinged set of frame members in a down position whereby the storage structure is closed.

FIG. **4** is a side view of the storage structure or hangar of the present invention, the view showing a second hinged set of frame members in a raised position whereby the storage structure is open.

FIG. **5** is a diagramatic top plan view of the storage structure or hangar of the present invention, the view showing a second hinged set of frame members in a raised position whereby the storage structure is open, and a sailplane is being maneuvered into placement within the structure.

FIG. **6** is an enlarged view of an area shown in FIG. **5**.

FIG. **7** is a perspective view of the substantially T-shaped truss or upper frame support of the storage structure or hangar of the present invention.

FIG. **7A** is a schematic, simplified perspective view of the substantially T-shaped truss or upper frame support of the storage structure or hangar and of the first and second sets of frame members attached to the truss, without showing any cross-bracing members or panels covering the frame members.

FIG. **8** is a diagrammatic top plan view showing the location of the first and second frame members which form the walls of the storage structure or hangar of the present invention.

FIG. **9** is a cross-sectional view, taken on lines **9**,**9** of FIG. **8**.

FIG. **10** is a cross-sectional view taken on lines **10**,**10** of FIG. **9**, the view showing the juncture of two members of rectangular cross-section which are part of the truss.

FIG. **11** is a plan view taken on lines **11,11** of FIG. **9**, the view showing attachment of the truss or upper frame support to the first set of frame members.

FIG. **12** is a cross-sectional view taken on lines **12,12** of FIG. **11**.

FIG. **13** is a cross-sectional view taken on lines **13,13** of FIG. **9**, the view showing the attachment of two adjoining frame members.

FIG. **14** is an enlarged view taken of the area indicated by **14** on FIG. **9**, the view showing connection of two members which are part of the truss or upper frame support.

FIG. **15** is a cross-sectional view taken on lines **15,15** of FIG. **9**, the view showing connection of the truss to an anchor post.

FIG. **16** is a cross-sectional view, taken on lines **16,16** of FIG. **9**.

FIG. **17** is a view taken on lines **17,17** of FIG. **16**, the view showing connection of the truss to an anchor post.

FIG. **18** is a view taken on lines **18,18** of FIG. **17**.

FIG. **19** is a front plan view of the right half of the hangar of the present invention, the view showing the second set of the hinged frame members attached to the truss.

FIG. **20** is a view taken on lines **20,20** of FIG. **19**, the view showing a hinge in detail.

FIG. **21** is a front plan view of the front of the hangar of the present invention, the view showing the second set of frame members which enclose the cockpit, attached to the truss or upper frame support.

FIG. **22** is an enlarged view of the area indicated **22** in FIG. **21**.

FIG. **23** is a cross-sectional view taken on lines **23,23** of FIG. **22**.

FIG. **24** is a diagrammatic side view of the truss and of the second set of hinged frame members capable of enclosing the cockpit part of a plane, the view showing the cable and winch mechanism that raises and lowers the hinged frame members.

FIG. **25** is a cross-sectional view taken on lines **25,25** of FIG. **24**.

FIG. **26** is a view taken on lines **26,26** of FIG. **24**.

FIG. **27** is a diagrammatic side view showing the raised position of the second set of hinged frame members capable of enclosing the cockpit part of a plane.

FIG. **28** is a diagrammatic perspective view showing mechanical connection between the hinged frame members normally covering the cockpit and hinged frame members normally covering the wing of a plane in the storage unit of the invention.

FIG. **29** is an enlarged view of the are indicated at **29** on FIG. **24**, the view showing a locking mechanism for the storage unit of the present invention.

FIG. **30** is a diagrammatic top view of a channel or trough and a ramp utilized for moving a plane in and out of the storage structure or hangar of the present invention.

FIG. **31** is a diagrammatic cross-sectional view of a channel or trough and a ramp utilized for moving a plane in and out of the storage structure or hangar of the present invention, the view also showing a plane as it is being moved.

FIG. **32** is a diagrammatic cross-sectional view of a channel or trough and a ramp utilized for moving a plane in and out of the storage structure or hangar of the present invention, the view also showing a plane positioned for storage in the storage structure.

FIG. **33** is a cross-sectional view taken on lines **33,33** of FIG. **1**, the view showing attachment of corrugated metal siding to the first set of frame members.

FIG. **34** is a cross-sectional view taken on lines **34,34** of FIG. **33**.

FIG. **35** is a diagrammatic view showing a cable, electric and hand winches utilized for raising the hinged frame members of the storage structure or hangar of the present invention.

FIG. **36** is a circuit diagram of the electric components of the storage unit of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The following specification taken in conjunction with the drawings sets forth the preferred embodiment of the present invention in such a manner that any person skilled in the art can use the invention. The embodiment of the invention disclosed herein is the best mode presently contemplated by the inventor, although it should be understood that various modifications can be accomplished within the parameters of the present invention.

Referring now to the appended drawing figures, a preferred embodiment of the storage structure, storage unit or hangar **50** of the present invention is disclosed. It should be noted at the outset that the storage structure or hangar **50** of the present invention is designed primarily for storage of sailplanes which are also known as gliders. Sailplanes or gliders typically have small cockpits for one or two persons and the cockpits tend to be relatively low to the ground. Sailplanes or gliders also typically have long wings and a relatively narrow fuselage. All of the foregoing is especially true for the sailplanes that are made from fiberglass, carbon fiber or like synthetic material. Thus, the storage structure or hangar **50** of the present invention is primarily dimensioned for the housing of sailplanes, and in this specification the preferred embodiment of the storage structure or hangar **50** is shown and described in connection with the housing of a single sailplane. However, the invention is not so limited and the storage structure **50** of the invention can also be readily adapted for the housing and storage of other small aircraft, for example a small power plane.

It is an important feature of the storage structure or hangar **50** of the present invention that it can be readily assembled from pre-fabricated parts at a desired site, such as an airfield, where sailplanes operate. Principal components or parts of the storage structure or hangar **50** include a substantially T-shaped truss or upper frame support **52** that is best shown by itself in FIG. **7**. Conceptually, the T-shaped truss or upper frame support **52** has a frontal part **54** to which structures housing the wings and cockpit of a sailplane are mounted, and a rear part **56** to which structures housing the fuselage are mounted. The T-shaped truss or upper frame support **52** is advantageously pre-fabricated from steel in several sections and is assembled at the desired site from the several pre-fabricated sections. In the presently preferred embodiment the frontal part **54** is assembled from five pre-fabricated sections **58**, and the rear part **56** is assembled from two pre-fabricated sections **58**. Preferably, as in the herein described preferred embodiment each pre-fabricated section **58** is made of steel bars of substantially rectangular cross-section which are welded together to form the respective pre-fabricated section **58**. As is shown in FIGS. **9** and **14**, the pre-fabricated sections **58** are attached to one another by bolts **60** and nuts **62**. Moreover, adjoining linearly lined up bars of the sections **58** are linked with a reinforcing

internal steel tube or bar **64**, shown in FIG. **10**. FIGS. **7**, **9**, **17** and **18** illustrate that the T-shaped truss **52** is attached to and is supported in its elevated position by three vertical posts **66** which are embedded in the ground **68**, preferably in concrete **70**. The cross-sectional view of FIG. **15** illustrates in detail the mounting of the T-shaped truss **52** into the vertical post **66** by bolt **72** and nut **74**.

The simplified diagrammatic view of FIG. **7**A illustrates conceptually the mounting and location of first and second set of frame members to the substantially T-shaped truss **52**. FIG. **7**A is simplified for illustration, because it does not show vertical and diagonal reinforcing bars that form part of these structures. However, the vertical and diagonal reinforcing bars are amply illustrated in other drawing figures. The first set of frame members **76** rests on the ground and is also attached to the truss **52**. FIGS. **11** and **12** show that the truss **52** includes tabs **78** that are mounted with bolts **80** and nuts **82** to the first set of frame members **76**. The first set of frame members **76** is also preferably pre-fabricated in multiple sections **84** and in the preferred embodiment these sections are attached to one another by the hose clamps **85**, as shown in detail by FIG. **13**. The first set of frame members **76** has no moving parts in the assembled storage structure or hangar **50** of the invention, and serve to support cover members or panels **86** which actually enclose a sailplane **88** in the storage structure or hangar **50** of the invention and protect it from rain, solar rays and other exposure to the elements. The second set of frame members **90**, also shown conceptually in FIG. **7**A, is attached in part to the truss **52** and in part to the first set of frame members **76**. More specifically, the second set of frame members **90** include parts **92** which are hingedly attached to a frontal horizontal member **94** of the truss **52** and parts **96** which are hingedly attached to frontal horizontal members **98** of the first set of frames **76**. This attachment is by hinges **100** and is perhaps best shown in FIGS. **19** and **21** while FIG. **20** shows the hinge **100** in detail. The second set of frame members **90** is also preferably pre-fabricated from several sections **102**, as shown in FIG. **19** for the part that is included in the right side of the hangar **50** and which provides the front cover for one wing of the sailplane **88** to be stored in the hangar **50**. The sections **102** shown in FIG. **19** are attached to one another by nuts **104** and bolts **106**, although other types of attachment may also be used.

Generally speaking, connections or mounting between mechanical parts such as welding, bolting, using hose clamps or other types of clamps, U-bolts or types of mechanical fasteners are well known in the art. In many instances, which will be readily apparent to those skilled in the art in light of the present disclosure, the herein described and other types of known mechanical fastening devices and means are interchangeable or equivalent. For this reason, a person of ordinary skill in the art may be able to build on the basis of the present disclosure the hangar or storage structure **50** of the present invention utilizing different types of mechanical fasteners than the ones specifically described in connection with the preferred embodiment. For example, hose clamps may be substituted with bolts and nuts or welding. Bolts, nuts and other type of mechanical fasteners can, in many instances, be replaced by welding the respective parts together and such apparent variations or modifications of attaching parts together are within the scope of the present invention.

FIG. **8** also shows the location of first and second sets of frame members **76** and **90** in the storage structure or hangar **50** of the present invention relative to the truss **52** and a sailplane **88** which may be stored in the structure **50**. FIGS. **1** through **4** shows the structure or hangar **50** with the cover members or panels **86** mounted on the first and second sets of frame members **76** and **90**. A door **108** is located in one of the sections **84** of the first set of frame members **76** to allow access to the interior of the storage structure or hangar **50**.

The cross-sectional views of FIGS. **33** and **34** show in detail the mounting of the cover member or panel **86** to the frame members **76** and **90**. The cover members or panels **86** of the presently preferred embodiment comprise corrugated metal plates **86**, which are attached to the frames **76** and **90** with self-tapping sheet metal screws **110**. Foam **112** is located between the corrugated metal panels **86** and the frame members **76** and/or **90** to provide insulation. Instead of corrugated metal plates **86**, wood or plastic panels could also be attached to the members **76** and/or **90** to enclose the sailplane **88** and protect it from the elements.

Referring now primarily to FIGS. **3**, **4** and **21** through **28**, opening and closing the storage unit or hangar **50** of the present invention is disclosed. A winch **114** is mounted to a vertical member **116** of the second set of frame **90** that serves as cover for the cockpit of the sailplane **88**. A cable or wire **118** is attached to the winch **114** and is lead through pulleys **120** to a second winch **122** in the rear of the structure **50**. The second winch **122** is shown in FIG. **16**. In the preferred embodiment the winch **114** is powered by a 12 volt battery **124**. The battery **124** is charged by a solar panel **126** that is placed on one of the cover plates **86**. The battery **124** and solar panel **126** are shown in FIG. **36**. Rotation of the winch **114**, powered by the battery **124** winds-up or releases the cable **118** depending on the polarity of the current which is supplied to it through a switch **128** shown in FIG. **36**. The second winch **122** of the preferred embodiment is hand operated and is intended for use only when for some reason or another the first winch **114** is inoperative. In alternative embodiments both winches may be electrically powered and/or may be powered by 110 AC current rather than by a D.C. battery.

When the winch **114** is powered through the switch **128** to take up the cable **118**, the hinged second set of frame members **90** are lifted so as to allow the movement of a sailplane **88** into or out of the hangar **50**. More specifically, first that part of the frame members **90** is lifted together with the corresponding cover panels **86** which encloses the cockpit of the sailplane **88**. The winch **114** rides up on the cable **118** together with the frame member **116** to which it is mounted. Sides of the frame members **90** are connected with a link **130** to the respective the frame members **90** that are hingedly mounted to the frontal horizontal members **98** and enclose the wings of the sailplane **88**. Details of the operation of the link **130** that in essence links the cockpit cover door with the wing cover door, are shown in FIGS. **22**, **23**, **27**, and **28**. As these figures disclose, the link **130** is mounted to the respective frames members **90** in such a manner that the frame members **90** can pivot relative to the link **130**. Thus, as the frame members **90** forming the cockpit cover are lifted, the link **130** also lifts the frame members **90** forming the front cover for the wings of the sailplane **88**. When the polarity of current is reversed by the switch **128**, the winch **114** unrolls cable **118** and the frame members **90** forming the cockpit and wing covers are lowered, thereby closing the structure **50** and enclosing the sailplane **88** that may be present in the storage structure or hangar **50**. Limit switches **132** shown in FIG. **36** prevent lifting the hinged frame members **90** too high or lowering them too low and therefore prevent damage to the structure.

FIGS. **5**, **6** and **30** through **32** disclose other features of the storage unit or hangar **50** of the present invention which

further facilitate the movement of a sailplane **88** into and out of the storage structure **50**. Specifically FIGS. **5** and **6** disclose a substantially circular indentation **136** or shallow dent in concrete **70** embedded in the ground **68** at a distance from the front of the structure **50** which substantially corresponds to the length of the wing of the sailplane **88** that is to be stored in the structure **50**. This makes it easy for a person (not shown) to push a sailplane **88** with its fuselage parallel with the front of the storage structure or hangar **50** at the proper distance from the structure **50** until the front wheel **138** of the sailplane **88** rests in the indentation **136**. Then the sailplane **88** is pivoted 90 degrees on its front wheel **138**, as shown in FIG. **5**, before its is pushed into the structure **50** for storage.

FIGS. **30** through **32** disclose a trough **140** formed inside the structure **50** and in alignment with the rear part **56** of the T shaped frame support **52**. In the presently preferred embodiment the trough **140** is comprised of a 4" by 6" wooden board **142** that is disposed flat on the ground **68** and of two 4" by 4" or 4" by 6" wooden boards **144** positioned on their respective edges and attached to the 4" by 6" board **142** by wood screws (not shown). In alternative embodiments the trough **140** may be made of metal or plastic or of any combination of wood, metal and plastic materials.

As is known by those who are familiar with sailplane operations, sailplanes are frequently moved around by attaching a tail dolly **146** to the rear part of the fuselage **147**, as is shown in FIGS. **31** and **32**. The tail dolly **146** causes the tail wheel **148** of the sailplane **88** to be lifted off the ground **68**, however the tail dolly **146** must not be attached to the sailplane **88** during flight because it significantly changes the weight and balance and is likely to cause a serious accident. Nevertheless use of the tail dolly **146** greatly facilitates transportation of the sailplane **88** on the ground, as for example when the sailplane **88** is moved from the hangar **50** to a take-off line, or when it is returned to the hangar **50** after flight. It is also customary to remove the tail dolly **146** from the fuselage **147** when the sailplane **88** is stored or hangared, principally because during prolonged storage the pressure by the straps and buckles attaching the tail dolly **146** to the fuselage **147** may discolor or damage the delicate synthetic material of the sailplane **88**.

To facilitate the movement of a sailplane **88** with a tail dolly **146** into and out of the storage structure or hangar **50** of the present invention and to avoid the need for lifting the relatively heavy tail of the sailplane **88** when the tail dolly **146** is removed, a ramp **150** is placed at the end of the trough **140** in a location where the tail wheel **148** of the sailplane **88** is to be located. The sloping part **152** of the ramp **150** begins high enough so that the tail of the sailplane **88** clears it as the sailplane **88** is pushed into the hangar **50** with the wheel **154** of the tail dolly **146** and the sailplane's front wheel **138** rolling in the trough **140**. To store the sailplane **88** and to render it easy to remove the tail dolly **146** the sailplane **88** is moved until its rear wheel **148** rests in an oval depression **156** provided in the ramp **150**, as is shown in FIG. **32**. In this position the wheel **156** of the tail dolly **146** is lifted off the trough **140** and the tail dolly **146** can be readily removed, and also reassembled when it is desired to move the sailplane **88** out of the storage unit **50**.

FIG. **29** illustrates an optional lock **158** which may be attached to one of the 4" by 4" or 4" by 6" boards forming the trough **140** and to a panel **86** to prevent unauthorized opening of the structure or hangar **50**. Another lock (not shown) is usually provided in the door **108**.

As noted above the storage structure or hangar **50** is preferably made from pre-fabricated parts. Although the steps of building the structure **50** should be apparent to those skilled in the art from the foregoing description, the preferred method of construction is briefly described below.

First and preferably a location on the ground **68** is prepared by selecting a suitable flat area, the trough **140** is built from wooden boards and the ground **68** is preferably covered with light gravel (not shown) to cover the base of the structure **50**. The vertical posts **66** are embedded in concrete **70** in the ground **68**, and the substantially T-shaped truss **52** is mounted to the vertical posts **66**. Sections **84** of the first set of frame members **76** are then placed on the ground and mounted to the truss **52**, and to each other, as applicable, followed by sections **102** of the second set of frame members **90** mounted with hinges **100** to the truss **52**, to each other, and to the first set of frames **76**, as applicable. The truss **52** and the frame members **76** and **90** can then be painted if so desired, and if they have not been painted before. Subsequently, the battery **124**, the switches, the door **108**, winches **114** and **122** and the cover plates or panels **86** and insulating foam **112** are mounted to the structure.

What is claimed is:

1. A storage structure for an aircraft to protect the aircraft from the elements, the storage structure comprising:

an upper frame support anchored to the ground at a plurality of locations;

a first set of frame members mounted immovably to the upper frame support in areas where fuselage, tail and wings of the aircraft are to be located when the aircraft is in the storage structure;

a second set of frame members hingedly mounted partly to the upper frame support and partly to the first set of frame members in areas where the cockpit, nose and wings of the aircraft are to be located when the aircraft is in the storage structure, the first and second set of frame members including cover members mounted to said first and second set of frame members, the hinged second set of frame members capable of occupying a first position where the structure is closed and the cover members completely enclose the aircraft, and a second position wherein the second set of frame members are raised relative to the first position where the structure is open and the aircraft can be moved into and out of the structure;

means for raising the second set of frame members from the first position to the second position thereby opening the structure and for lowering the second set of frame members from the second position to the first position, thereby closing the structure, and

wherein the upper frame support comprises a plurality of pre-fabricated sections, said sections being fixedly attached to one another.

2. A storage structure in accordance with claim **1** where the upper frame support is substantially T-shaped.

3. A storage structure in accordance with claim **1** where the means for raising and lowering the second set of frame members comprise a winch and associated cable.

4. A storage structure in accordance with claim **1** where the means for elevating and lowering the second set of frame members are electrically powered.

5. A storage structure in accordance with claim **1** further comprising a plurality of hollow posts anchored in the ground and where the upper frame support is fixedly mounted to the hollow posts.

6. A storage structure in accordance with claim **1** where the cover members comprise corrugated metal panels.

7. A storage structure for an aircraft to protect the aircraft from the elements, the storage structure comprising:

an upper frame support anchored to the ground at a plurality of locations;

a first set of frame members mounted immovably to the upper frame support in areas where fuselage, tail and wines of the aircraft are to be located when the aircraft is in the storage structure;

a second set of frame members hingedly mounted partly to the upper frame support and partly to the first set of frame members in areas where the cockpit, nose and wings of the aircraft are to be located when the aircraft is in the storage structure, the first and second set of frame members including cover members mounted to said first and second set of frame members, the hinged second set of frame members capable of occupying a first position where the structure is closed and the cover members completely enclose the aircraft, and a second position wherein the second set of frame members are raised relative to the first position where the structure is open and the aircraft can be moved into and out of the structure;

means for raising the second set of frame members from the first position to the second position thereby opening the structure and for lowering the second set of frame members from the second position to the first position, thereby closing the structure, and located in the area defined by the first set of frame members, the ramp comprising means for receiving a tail wheel of an aircraft to be stored in the structure and for holding the tail of the aircraft in an elevated position.

8. A storage structure in accordance with claim 7 further comprising a trough leading to the ramp, the trough comprising means for guiding a tail wheel of the aircraft to the ramp.

9. A storage structure for an aircraft to protect the aircraft from the elements, the storage structure substantially conforming to the shape of the aircraft, said storage structure capable of being assembled from pre-fabricated parts and comprising:

a substantially T-shaped upper frame support anchored to the ground at a plurality of locations;

a first set of frame members mounted immovably to the upper frame support in areas where fuselage, tail and wings of the aircraft are to be located when the aircraft is in the storage structure;

a second set of frame members hingedly mounted partly to the upper frame support and partly to the first set of frame members in areas where the cockpit, nose and wings of the aircraft are to be located when the aircraft is in the storage structure, the first and second set of frame members including cover members mounted to said first and second set of frame members, the hinged second set of frame members capable of occupying a first position where the structure is closed and the cover members completely enclose the aircraft, and a second position wherein the second set of frame members are raised relative to the first position where the structure is open and the aircraft can be moved into and out of the structure;

electrically operable winch means for raising the second set of frame members from the first position to the second position thereby opening the structure and for lowering the second set of frame members from the second position to the first position, thereby closing the structure, and wherein the winch means include a winch fixedly attached to the second set of frame members and a cable attached to the winch, the cable also being attached to non-moving part of the structure.

10. A storage structure in accordance with claim 9 wherein the winch means further include a manually operable winch to which the cable is attached, the manually operable winch being attached to a non-moving part of the structure.

11. A storage structure in accordance with claim 9 further including a battery and a solar panel, said battery being operatively connected to the electrically operable winch means to power the electrically operable winch means, and the solar panel being operatively connected to the battery to charge the battery.

12. A storage structure in accordance with claim 9 where the cover members comprise corrugated metal panels.

13. A storage structure in accordance with claim 9 further comprising insulating foam mounted between the corrugated metal panels and the respective first and second frame members to which the panels are attached.

14. A storage structure in accordance with claim 9 further comprising a ramp located in the area defined by the first set of frame members, the ramp comprising means for receiving a tail wheel of an aircraft to be stored in the structure and for holding the tail of the aircraft in an elevated position.

15. A storage structure in accordance with claim 14 further comprising a trough leading to the ramp, the trough comprising means for guiding a tail wheel of the aircraft to the ramp.

16. A storage structure for a sailplane to protect the sailplane from the elements, the storage structure substantially conforming to the shape of the sailplane, said storage structure capable of being assembled from pre-fabricated parts and comprising:

a substantially T-shaped upper frame support anchored to the ground at least at three locations;

a first set of frame members mounted immovably to the upper frame support in areas where fuselage, tail and wings of the sailplane are to be located when the sailplane is in the storage structure;

a second set of frame members hingedly mounted partly to the upper frame support and partly to the first set of frame members in areas where the cockpit, nose and wings of the sailplane are to be located when the sailplane is in the storage structure, the first and second set of frame members including cover members mounted to said first and second set of frame members, the hinged second set of frame members capable of occupying a first position where the structure is closed and the cover members completely enclose the sailplane, and a second position wherein the second set of frame members are raised relative to the first position where the structure is open and the sailplane can be moved into and out of the structure;

electrically operable winch means for raising the second set of frame members from the first position to the second position thereby opening the structure and for lowering the second set of frame members from the second position to the first position, thereby closing the structure, the winch means including a winch fixedly attached to the second set of frame members and a cable attached to the winch, the cable also being attached to an non-moving part of the structure;

a ramp located in the area where the tail of the sailplane is to be located when the sailplane is in the storage structure, the ramp comprising means for receiving a

tail wheel of the sailplane and for holding the tail of the sailplane in an elevated position;

a trough leading to the ramp, the trough comprising means for guiding a tail wheel of the sailplane to the ramp; a battery and a solar panel, said battery being operatively connected to the electrically operable winch means to power the electrically operable winch means, and the solar panel being operatively connected to the battery to charge the battery.

17. A storage structure in accordance with claim **16** further comprising switch means operatively connected to the battery and the electrically operable winch means, the switch means being adapted for providing direct current of either polarity to the electrically operable winch means at the option of a user, whereby the second set of frame members are raised or lowered at the option of the user to open or close the structure.

18. A storage structure in accordance with claim **17** where the cover members comprise corrugated metal panels.

19. A storage structure m accordance with claims **18** further comprising insulating foam mounted between the corrugated metal panels and the respective first and second frame members to which the panels are attached.

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